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Toward an Evidence-Based Nuclear Energy Policy

What Congress Needs to Know About Nuclear Decommissioning, Radioactive Waste, and Nuclear Energy as a Climate Strategy

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Agenda

1) Overview of nuclear waste in Europe
2) Waste management in Germany
3) Waste management in Switzerland
4) Economics of SMR

Overview: High-level waste (spent nuclear fuel) storage in Europe

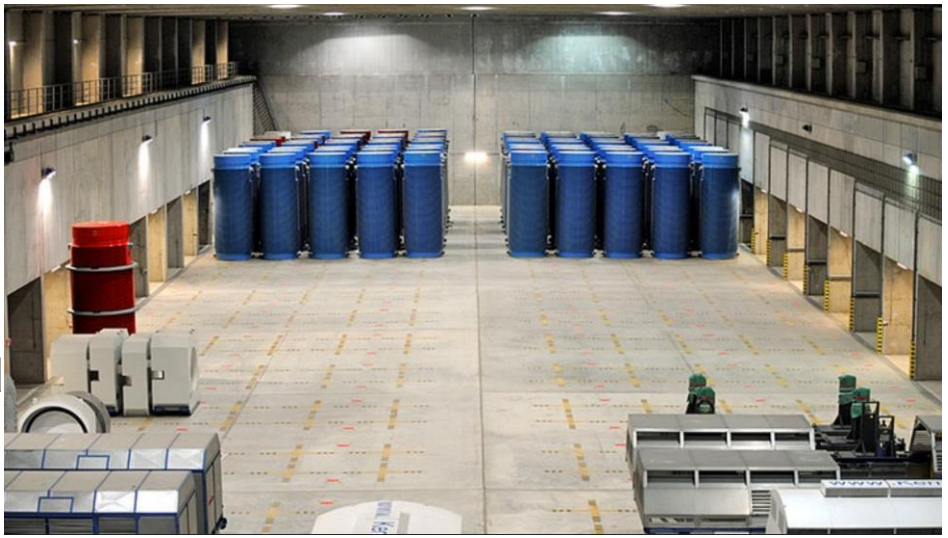
Overview

- More than 60,500 tons of spent nuclear fuel in interim storage (in the US: 81,518 tons)
- Reprocessing of fuel is still done in some countries (France, Netherlands, Russia), while most countries have abandoned it (Belgium, Bulgaria, Germany, Hungary, Sweden, Switzerland, and most recently the U.K.)
- Europe wide the majority of fuel is still stored in wet storage (81%)
- Only 19% have been moved to dry storage
- Data from latest national reports under Joint Convention Safety of Spent Fuel and Radioactive Waste Management Reports

Available at: https://worldnuclearwastereport.org/

Interim storage in Germany

- **Pre-2012: Interim storage in three centralized interim storage facilities operated by utilities-owned subsidiary.**
- **Interim storage in decentralized interim storage facilities (on-site, 12 sites).**
- **Ownership of the facilities was transferred to a federally owned company (BGZ).**
- **Technical concept: storage casks and halls with a passive cooling system**
- **Since 2011: Retrofitting measures are required (e.g., erection of an additional ten meters high wall).**
- **Independent experts: measures are applied to slowly and not enough.**
- **Some unresolved issues: license termination, no hot cell.**



Interim storage facility Gorleben, Source: dpa Foto: Kay Nietfeld

Wall erection at interim storage facility Ahaus, source: Bödding/Münsterland Zeitung

Interim storage in Switzerland

- **Decentralized dry (Beznau) and wet storage (Gösgen) of spent fuel**
- **Centralized interim storage facility ZWILAG for all HLW (spent nuclear fuel, vitrified waste, also from medicine, industry)**
- **Technical concept: storage casks and halls with a passive cooling system.**
- **Operated by a stock corporation, which is owned by the Swiss nuclear power plant operating companies. The share capital is divided in proportion to the output of the nuclear power plants.**
- **Includes conditioning plant, storage hall, hot cell.**

Interim storage facility Zwilag, Source: www.zwilag.ch

Interim storage facility Zwilage, source: kernenergie.ch

Expert Report on SMR by BASE (German nuclear regulatory agency)

Key economic findings:

- Due to the low electrical power, the **specific construction costs are higher** than for large nuclear power plants due to the loss of economies of scale.
- SMRs promise shorter production times as well as lower production costs due to their modularity. Individual components or even the entire SMR are to be **industrially (mass) produced**.
- **But** a production cost calculation taking into account scale, mass and learning effects from the nuclear industry shows that, **an average of three thousand SMRs would have to be produced before it would be worthwhile** to start SMR production for a reactor vendor.
- Thus, **it is not expected that the structural cost disadvantage of small-capacity reactors can be compensated** by learning or mass effects.
- As with large-capacity nuclear plants, the **supply** of SMRs is **predominantly government-owned or demand-led** (end users, military).
- Most advanced SMR concepts are light-water reactors with a small output. Here are **no start-ups active** (f.i. major shareholder behind NuScale is Fluor).
- While spin-offs from government-funded large-scale research institutions are also developing, their business models are also based on **long-term government funding**.
- Another justification is the expectation of **shorter construction times**. Looking at plants currently under construction or operation, this assumption does **not appear to be empirically founded.**

Available (in German, with English summary at: https://www.base.bund.de

Thank you for your attention!

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